

Brookhaven National Laboratory Relativistic Heavy Ion Collider Facility

Facility Environmental Monitoring Report

Calendar Year 2001



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RHIC Facility Environmental Monitoring Report CY 2001

***Summary of Results:** During Calendar Year 2001 no environmental impacts from RHIC operations were identified.*

Sample results indicate that the surface water and groundwater contain only naturally occurring radionuclides, and at concentrations that are consistent with established background levels.

Results from environmental TLDs positioned around the RHIC facility indicate the mean dose rate for the first quarter was 22.0 mrem, second quarter was 20.0 mrem, third quarter was 18.0 mrem, and the fourth quarter reading was 20.0 mrem. The variation was statistically insignificant for each quarter and within natural background readings in the RHIC area.

During CY 2001, there were two apparent SPDES permit excursions for hydroxyethylidene-diphosphonic acid (HEDP) at outfalls contributed to by RHIC discharges. However, due to anomalies in the analytical data, and subsequent comparison with split sample results from a second contractor laboratory, the detection of HEDP could not be verified.

Background

Beam line interaction with the Relativistic Heavy Ion Collider's (RHIC) collimators and beam stops will produce secondary particles that will interact with some of the soils surrounding the 8 o'clock and 10 o'clock portions of the RHIC tunnel, and the W-Line stop. These interactions will result in the production of tritium and sodium-22, which could be leached out of the soils by rainwater. Because the BNL site is located over an EPA designated sole-source aquifer system, BNL has implemented a number of engineering and process controls to reduce the potential impact to environmental quality. Additionally, discharges from RHIC cooling systems are regulated under the New York State, State Pollutant Discharge Elimination System (SPDES) permit program.

Environmental Monitoring Program

As required by DOE Order 5400.1, BNL has established an environmental monitoring program at the RHIC facility to evaluate potential impacts to environmental quality from its operation, and to demonstrate compliance with DOE requirements and applicable federal, state and local laws and regulations.

The environmental monitoring program for the RHIC facility is described in the BNL Environmental Monitoring Plan (Daum *et al.* 2000; BNL 2001). The monitoring programs are summarized below.

Monitoring Results

Groundwater

During 1999-2000, thirteen wells were installed to provide a means of verifying that the engineered (i.e., impermeable caps) and operational controls implemented at the RHIC beam stops and collimators are effective in protecting groundwater quality. Six monitoring wells were installed in the beam stop area, six wells in the collimator area, and one well near the W-Line Beam Stop (Figure 1).

Groundwater samples were collected from the thirteen RHIC monitoring wells on a semiannual schedule during 2001. These samples were analyzed for tritium and gamma emitting radionuclides (Table 1). No tritium or sodium-22 was detected in any of the groundwater samples.

Surface Water

Because the southern beam stop is located within 200 feet of the culvert for the Peconic River, surface water samples are collected to verify that potentially activated groundwater is not being discharged to the stream bed during high water table conditions. When surface water is present, water samples are collected at an upstream location near Upton Road (location 025-650, also known as HY) and a downstream location near the Ring Road (location 026-650, HV).

During the monitoring period, surface water samples were collected twice from upstream location 025-650 and twice at downstream location 026-650. No tritium or sodium-22 was detected in these samples (Table 2).

Environmental TLDs

Environmental thermoluminescent dosimeters (TLDs) are used to measure direct penetrating radiation in the environment. These TLDs measure ambient external dose to living organisms. During 2001, ambient radiation external dose measurements were evaluated for the RHIC area using 11 environmental TLDs during the operational phase (Figure 2, Table 3). The mean dose rate for all location around RHIC for the first quarter was 22.0 mrem, second quarter was 20.0 mrem, third quarter was 18.0 mrem, and the fourth quarter reading was 20.0 mrem. The variation was statistically insignificant for each quarter and within natural background readings in the RHIC area.

SPDES Monitoring

Historically, sanitary wastes from the RHIC facilities were either discharged to the BNL sanitary sewer system or to subsurface wastewater disposal systems. During 2000 - 2001 a significant effort was made to connect the RHIC site to the BNL sanitary sewer. This work was completed by June 2001. Monitoring of the site sanitary sewer is performed at the treated effluent discharge to the Peconic River.

Experimental cooling towers located at 1006, 1008, 1010, and 1002, cryogen cooling towers at 1005, and RF cooling systems at 1004, routinely discharge “blowdown” to either the ground surface or to the site stormwater collection system. Discharges from the Cryogenic plant at Building 1005 are conveyed to Outfall 002 (Figure 3). The discharges from these systems are regulated under the New York State, State Pollutant Discharge Elimination System (SPDES) permit program. These discharges are monitored for residual corrosion control agents, flow, pH, oil and grease, as applicable.

During CY 2001, there were five apparent SPDES permit excursions for hydroxyethylidene-diphosphonic acid (HEDP) at outfalls 002, 002B, 005, 006A and 006B. The RHIC contributes wastewater to two of these discharges (002, and 002B). However, due to anomalies in the analytical data (provided by CHEMTEX, Inc.) and comparison with split sample results from a second contractor laboratory (H2M Labs, Inc.), the validity of the HEDP detections in the discharge from the two outfalls is suspect. Historically, HEDP has not been detected at any of the outfalls.

Environmental Surveillance Monitoring: In addition to SPDES monitoring, all discharges are monitored quarterly for radionuclides, metals, volatile organic compounds and water chemistry parameters.

During 2001, no radionuclides related to Laboratory operations were detected in the discharges to Basin 002. All gross alpha results were below the method detection limit (MDL), and the maximum gross beta concentration was detected in July at 3.2 pCi/L, just above the MDL of 2.1 pCi/L. Tritium was not detected in any of the samples, and only naturally occurring gamma emitting radionuclides were observed.

During January and April 2001, aluminum and iron were detected at 0.7 to 0.8 mg/L and 0.6 to 0.7 mg/L, respectively. These metals could be related to native sediment carried by stormwater run off and/or corrosion products associated with the cooling system piping.

Low levels of trihalomethanes (< 3.3 ppb) were sporadically detected in the RHIC discharges to outfall 002. However, these compounds are common potable water disinfection by-products, and not attributable to RHIC operations.

Future Monitoring Actions

The following actions are recommended or in progress:

- The groundwater monitoring wells will continue to be sampled semiannually, however the samples will only be analyzed for tritium. BNL will resume gamma analyses for sodium-22 if tritium is detected in any of the samples.
- In late 2001, BNL petitioned the NYSDEC to modify the Laboratory's SPDES discharge permit for RHIC outfall 002A. These changes were approved by the NYSDEC in early 2002. Monitoring at outfall 002A is no longer required because cooling water discharges have been rerouted to Outfalls 002 and 002B. Total aluminum was added to the monitoring parameters for outfall 002.

References

BNL, 2001. Brookhaven National Laboratory Environmental Monitoring Plan, CY 2001 Update (January 2001). BNL-52584 Update.

Daum, M., Dorsch, W., Fry, J., Green, T., Lee, R., Naidu, J., Paquette, D., Scarpitta, S., and Schroeder, G., 2000. Brookhaven National Laboratory, Environmental Monitoring Plan 2000 (March 31, 2000). BNL-52584.

BNL Facility Environmental Monitoring Report
Relativistic Heavy Ion Collider Facility
Groundwater Monitoring Program - Tritium and Sodium-22 Results (pCi/L)
Calendar Year 2001

Table 1

Building/Facility	Well	February 2001	August 2001
Northern Beam Stop Area	025-04	H3= <365 Na-22= ND	H3= <323 Na-22= ND
	025-07	H3= <365 Na-22= ND	H3= <321 Na-22= ND
	025-08	H3= <365 Na-22= ND	H3= <321 Na-22= ND
Southern Beam Stop Area	025-03	H3= <365 Na-22= ND	H3= <323 Na-22= ND
	025-05	H3= <365 Na-22= ND	H3= <321 Na-22= ND
	025-06	H3= <365 Na-22= ND	H3= <321 Na-22= ND
Northern Collimator	034-05	H3= <365 Na-22= ND	H3= <323 Na-22= ND
Southern Collimator	034-06	H3= <365 Na-22= ND	H3= <323 Na-22= ND
Downgradient of Collimator Area	043-01	H3= <305 Na-22= ND	H3= <310 Na-22= ND
	043-02	H3= <305 Na-22= ND	H3= <310 Na-22= ND
	044-13	H3= <305 Na-22= ND Be-7 = 33.8 +/- 11.5 (Note 1)	H3= <321 Na-22= ND
	044-14	H3= <305 Na-22= ND	H3= <321 Na-22= ND
W-Line Beam Stop	044-29	H3= <350 Na-22= ND	NS

NS: Well Not Sampled

Note 1: Although Be-7 is detected in activated soils, its presence in groundwater is suspect due to its short half-life (53 days), and none of the primary contaminants of concern (e.g., tritium and sodium-22) were detected. The Be-7 detection is probably due to sample or sample container cross contamination.

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Relativistic Heavy Ion Collider Facility
Surface Water Monitoring – Peconic River
Summary of Tritium and Sodium-22 Results**

Calendar Year 2001

Table 2

Location	Collect Date	Result (pCi/L)
025-650: Upstream of RHIC Beam Stop Area	January	H3= <331 Na-22= ND
	April	H3= <329 Na-22= ND
026-650: Downstream of RHIC Beam Stop Area	January	H3= <331 Na-22= ND
	April	H3= <329 Na-22= ND

Note 1: Ability to collect surface water samples is limited to periods of high water table position when there is base flow in the river.

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Quarterly Ambient Radiation Measurements
Calendar year 2001**

Table 3

TLD #	Location	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
		mrem			
011-400	N. Firebreak	17.0	16.9	18.7	18.9
017-400	P-2	16.5	15.9	15.2	17.2
025-400	B#1010 St.1	20.2	18.5	16.7	18.3
025-403	B# 1010 St. 4	20.5	20.3	17.3	20.1
034-400	N. Access Rd	19.9	19.5	17.9	20.1
034-401	N. Met	19.9	18.7	20.1	20.7
034-403	B#1008 C2	19.7	20.1	17.8	18.9
034-405	B#1008 C4	22.5	20.0	NR	22.9
037-400	S-13	19.7	16.9	16.2	18.4
044-400	Bldg. #1006	35.4	23.7	18.7	20.7
045-400	Bldg. #1005	27.1	24.4	18.8	20.7
Mean		22.0	20.0	18.0	20.0

NR = Dose was not reported due to lost TLD.

